Superfund Program

**Proposed Plan**
**Allied Paper Landfill**
**Allied Paper/Portage Creek/Kalamazoo River Superfund Site – Operable Unit 1**

## INTRODUCTION

This Proposed Plan identifies the Preferred Alternative for cleaning up the contaminated material at Operable Unit 1 (OU1) (commonly referred to as Allied Paper Landfill or Allied Landfill), of the Allied Paper/Portage Creek/Kalamazoo River Superfund site (Site), and provides the rationale for this preference. This Proposed Plan also includes summaries of other cleanup alternatives evaluated for Allied Landfill and provides basic information about Allied Landfill and the Site. This document is issued by U.S. Environmental Protection Agency (EPA), the lead agency for Site activities. Michigan Department of Environmental Quality (MDEQ) is the support agency. EPA, in consultation with MDEQ, will select a final remedy for Allied Landfill after it reviews and considers all information submitted during a 60-day public comment period on this Proposed Plan, which will run from September 30, 2015 to December 1, 2015. EPA, in consultation with MDEQ, may modify the Preferred Alternative or select another alternative presented in this Proposed Plan based on new information gathered during the comment period or from public comments. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan. Members of the public are encouraged to attend and participate in a public meeting at Washington Writers Academy in Kalamazoo, Michigan, on November 19, 2015 at 6:00 p.m.

This Proposed Plan was developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan relies on a risk-based method for polychlorinated biphenyls (PCBs) under the Toxic Substances Control Act (TSCA) and 40 C.F.R. § 761.61(c).

EPA is issuing this Proposed Plan as part of its public participation responsibilities under § 117(a) of CERCLA and § 300.430(f)(2) of the NCP. This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) reports and other documents contained in the Administrative Record. The Administrative Record for this Site can be accessed at the following locations:

Kalamazoo Public Library
315 South Rose
Kalamazoo, MI (269) 342-9837 (call for hours)

EPA's Region 5 Records Center
77 West Jackson Boulevard
Chicago, IL 60604
Monday - Friday 8:00 a.m. – 4:00 p.m. 312-353-1063 (call for appointment; central time)

EPA and MDEQ encourage the public to review the RI and FS reports and other documents in the Administrative Record to gain a more comprehensive understanding of the Allied Landfill and the Superfund activities that were conducted to date at OU1.

EPA is proposing that Alternative 2D be selected as the remedy for OU1. Alternative 2D involves excavating contaminated soils, sediments, and residuals from the Monarch area of OU1, from commercial, residential, and wetland areas of OU1, and from areas near Portage Creek; and consolidating those materials into the main body of the landfill area of OU1. Portions of the landfill area itself would also be excavated and consolidated, reducing the footprint of the waste from approximately 49 acres to approximately 27 acres. After consolidation, the landfill area would be covered with an impermeable cap and an active gas collection system would be installed. Excavated and backfilled areas that are not used for flood control would potentially be available for commercial redevelopment. The capped area would potentially be available for light recreational reuse. Alternative 2D also includes long-term groundwater monitoring to verify the effectiveness of the remedy, institutional controls to protect the remedy and restrict land and groundwater use, and long-term operation and maintenance (O&M). More details regarding the proposed alternative, as well as the other alternatives that were considered by EPA, are provided later in this Proposed Plan.

## SITE BACKGROUND

The Site is located in Allegan and Kalamazoo counties in southwest Michigan. The Site includes over 80 miles of the Kalamazoo River and Portage Creek, adjacent floodplains and wetlands, paper-residual disposal areas, and former paper mill properties, all pervasively contaminated with PCBs as the result of the recycling of carbonless copy paper. EPA listed the Site on the National Priorities List in 1990, and the State of Michigan posted fish advisory warnings against consumption of certain Kalamazoo River fish within the Site as early as 1977. Fish consumption advisories remain in effect.

Currently, the Site is divided into the following operable units:

- OU1: Allied Landfill
- OU2: Willow Boulevard/A-Site Landfill
- OU3: King Highway Landfill
- OU4: 12th Street Landfill
- OU5: Kalamazoo River and Portage Creek
- OU7: Plainwell Mill

This Proposed Plan addresses OU1, which is located on 89 acres within the city limits of Kalamazoo, Michigan. OU1 is defined as the areas between Cork Street and Alcott Street where contamination from paper manufacturing operations is located (Figure 1). Portage Creek runs through and bisects OU1. OU1 includes areas that are zoned for residential, commercial, and manufacturing uses. Residential development exists along part of the eastern side of OU1, and a railroad corridor forms part of the western boundary. Commercial and manufacturing properties are located north and south of OU1 and along portions of the eastern and western sides of OU1.

Paper mills were located on or near OU1 beginning at least as early as the 1870s. From the 1950s through the 1970s, as part of the papermaking process, those mills recycled carbonless copy paper, which contained PCBs as a carrier for the ink. Wastewater generated in that process was contaminated with PCBs, which adsorbed or adhered to suspended particles such as cellulose and clay in the wastewater.

Paper mills associated with OU1 include mills referred to as the Bryant Mill and the Monarch Mill, both of which were owned and operated by various companies at different times. The Bryant Mill was located on the northern part of OU1, both north and south of Alcott Street, while the Monarch Mill was located east and south of Portage Creek across from the rest of OU1. These mills included carbonless copy paper recycling in their operations. The portion of the Bryant Mill located south of Alcott Street is a part of OU1. The portion of the former Bryant Mill located north of Alcott Street is a part of the Site, but not a part of OU1.

The mills either discharged contaminated wastewater directly to Portage Creek or its impounded area referred to as the Bryant Mill Pond (also referred to as the Pond), or first dewatered the wastewater in settling lagoons, which were intended to remove some of the suspended particles in the wastewater prior to discharge. Settling lagoons were located at areas of OU1 now referred to as the Bryant Historic Residuals Dewatering Lagoon (HRDL) and Former Residuals Dewatering Lagoons (FRDLs), and the Monarch HRDL (Figure 2).

The Bryant Mill Pond was formed by the damming of Portage Creek at Alcott Street in 1895, impounding the creek within the northern part of OU1. The Alcott Street Dam was built in 1895 to provide hydroelectric power and to control water for the Bryant Paper Mills. In 1976, the then owner, Allied Paper Company, drew down the water level of Bryant Mill Pond in an effort to reduce the discharge of sediment or groundwater to Portage Creek. Surface water in Portage Creek was lowered 13 feet during the drawdown, which exposed contaminated sediments that had accumulated over many years of mill operations.

Allied Landfill Subareas

In addition to the areas described above, additional areas at OU1 became contaminated due to the papermaking operations. For purposes of managing OU1, EPA has organized the contaminated areas at OU1 into the following areas and subareas (Figure 2):

- **Former Operational Areas**— Consists of the Bryant HRDL and FRDLs, Monarch HRDL (including the Former Raceway Channel), and areas referred to as the Former Type III Landfill and the Western Disposal Area. PCBs were introduced to the HRDL and FRDLs through the residual dewatering operations. At times, contaminated residuals from these areas were excavated and disposed of in the Western Disposal Area and the Type III Landfill. Portions of contiguous properties, including the adjacent Panelyte Marsh, Panelyte Property, Conrail Railroad Property, and the State of Michigan's Cork Street Property, are included in the Former Operational Areas due to waste materials having encroached into these areas from the Western Disposal Area.

- **Former Bryant Mill Pond Area**—Includes the area within the boundary of the Former Bryant Mill Pond, prior to dewatering, defined by a historical impoundment elevation of 790 feet above mean sea level (AMSL). A portion of the Bryant Mill property south of Alcott Street is included within this area. During mill operations, the Former Bryant Mill Pond Area was contaminated through the discharge of contaminated wastewater.
- **Residential Properties (Outlying)**—Consists of residential properties that are part of OU1, but not contiguous with the Former Operational Areas, including the following: Clay Seam Area, East Bank Area, four adjacent residential properties (Golden Age Retirement Community and three single-family residences), and property owned by the Lyondell Environmental Custodial Trust but used by owners of the three single-family residences.
- **Commercial Properties (Outlying)**—Consists of commercial properties that are part of OU1, but not contiguous with the Former Operational Areas, including the following: the Goodwill property, the Consumers Power property, the Former Filter Plant and the Alcott Street Parking Lot (both owned by the Lyondell Environmental Custodial Trust), and part of the former Bryant Mill property located south of Alcott Street.

The Residential Properties (Outlying) and Commercial Properties (Outlying) are adjacent to the Former Bryant Mill Pond area and were contaminated by the use and flooding of the Pond.

**Prior Response Actions**

Between 1990 and 2004, a series of CERCLA response actions were completed at OU1 to minimize exposure to PCBs and to stop the ongoing release of PCBs from the Former Bryant Mill Pond Area to Portage Creek and the Kalamazoo River. Those actions are summarized below.

<u>Time-critical Removal Action at the Former Bryant Mill Pond</u>

In 1990, EPA ordered the installation of fencing to minimize access to contaminated areas at OU1. In order to remove a large, ongoing source of PCB contamination to Portage Creek and the Kalamazoo River, EPA then completed a time-critical removal action (TCRA) at the Former Bryant Mill Pond Area in 1998 and 1999. In this TCRA, EPA excavated 146,000 cubic yards ($yd^3$) of PCB-containing sediments, residuals, and soils from the creek banks and floodplains up to an elevation of 790 feet AMSL and placed those materials into the Bryant HRDL and FRDLs. EPA then backfilled the excavated area with clean fill and graded, seeded, and revegetated the backfilled area with native grasses and plants.

EPA's action level for the excavation was a PCB concentration of 10 milligrams per kilogram (mg/kg), with a goal of achieving post-excavation PCB concentrations less than or equal to 1 mg/kg. Only 5 of the 440 post-TCRA samples that EPA collected had PCB concentrations in excess of 1 mg/kg. The PCB concentration of these five samples ranged from 1.8 mg/kg - 3.8 mg/kg. Additionally, 410 of the post-excavation samples were below the 0.33 mg/kg screening-level criterion protective of people eating fish recommended by MDEQ.

Interim Response Measures

After completion of the Bryant Mill Pond TCRA, one of the owners of OU1 conducted a series of small-scale Interim Response Measures (IRMs) to restrict access to OU1 and to provide erosion control and stabilization in certain areas (Figure 2). The IRMs further mitigated the exposure to or transport of PCBs at OU1. The IRMs are summarized below and described in detail in the RI report:

- Installation of 2,600 feet of sealed-joint sheet pile along the Bryant HRDL and FRDLs adjacent to Portage Creek (Figure 2) to stabilize the perimeter berms that separate the materials in the Bryant HRDL and FRDLs from the Portage Creek floodplain. This IRM was completed in 2001.
- Removal of remnant structures from the former Bryant Mill operational areas.
- Removal of several hundred $yd^3$ of soil containing residuals from locations between the sheet pile wall and Portage Creek and consolidation of those materials into the Bryant HRDL and FRDLs. This material was removed in 2000 and 2003 to minimize the potential for contaminated material releases to Portage Creek.
- Construction of an engineered composite cap for the Bryant HRDL and FRDLs, with its design based on Michigan Act 451, Part 115, solid waste regulations. The cap was constructed between 2000 and 2004. The cap was installed as a barrier to minimize the potential for direct contact with PCB-containing materials.
- Installation and operation of a groundwater extraction system inside the sheet pile wall and beneath the cap. The purpose of the system was to mitigate groundwater mounding behind the sheet pile wall, which might compromise the cap or inundate otherwise unsaturated residuals and increase the potential for migration of PCBs to the creek.
- Removal of approximately 1,700 $yd^3$ of residuals located in the floodplain on the eastern side of Portage Creek (referred to as the East Bank Area) and additional PCB-containing soils between the sheet pile wall and the creek ( Figure 2). The materials were consolidated into the Bryant FRDLs prior to construction of the cap.

After cap installation, MDEQ expressed concerns that the flexible-membrane liner (FML), used as part of the cap, was left exposed for substantial periods of time. During this period, the cap was repeatedly punctured by wildlife. The then owner, Millennium Holdings LLC, subsequently repaired the cap, rather than replacing it as recommended, to address MDEQ concerns. MDEQ remains concerned about the current cap due to the number and quality of repairs that were made. As a result of the earlier damage, the current cap may not be fully mitigating the infiltration of precipitation that might form leachate.

The IRM methods and cleanup targets were similar to those used by EPA during the Former Bryant Mill Pond TCRA. Results of all post-excavation confirmation samples were below the target PCB removal action goal of 1 mg/kg, and the excavation was backfilled with a minimum of one foot of clean fill. Upland areas of the Former Bryant Mill Pond were subsequently seeded and revegetated with native plants. However, PCB concentrations greater than 1 mg/kg continue to exist in floodplain areas not addressed by the IRMs, specifically the seep areas. These areas will be addressed by this proposed remedy.

**Public Outreach to Date**

EPA has conducted extensive public outreach for OU1. Since 2007, EPA has provided OU1 updates to the public at quarterly and semi-annual Site-wide public meetings. EPA also held public meetings specifically about OU1, including two presentations in fall 2009. In January 2011, EPA presented the array of cleanup alternatives to the public. In 2013, EPA conducted OU1 tours for the mayor of Kalamazoo and citizen groups prior to publishing the FS in November 2013. EPA presented the FS in two open-house style meetings, one in February 2014 and another in April 2014. EPA held tours of OU1 for Congressman Upton and Senators Stabenow and Levin during the summer of 2014.

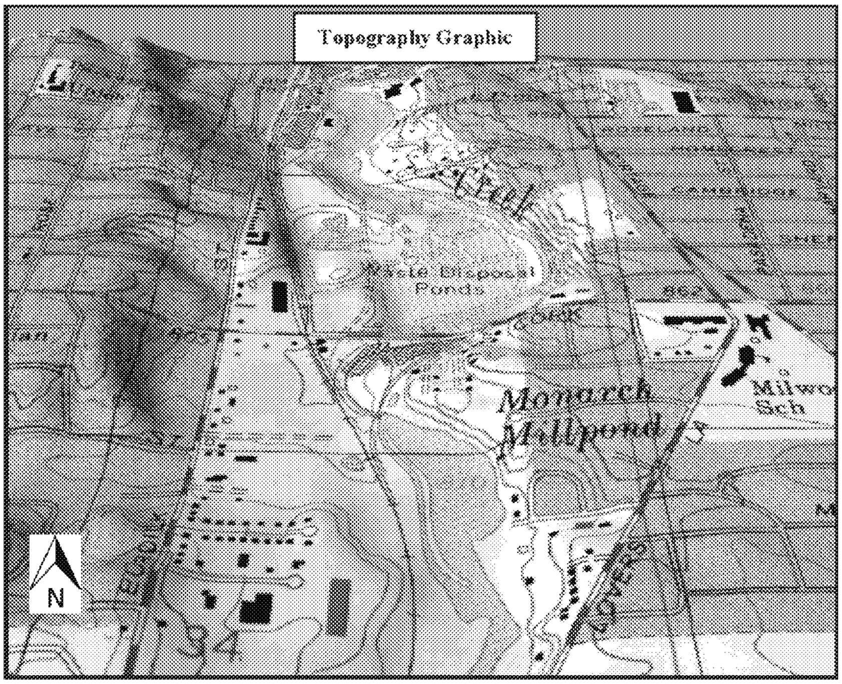
The City of Kalamazoo (City) had previously indicated that total removal of the waste was the only cleanup plan that it would support. Members of the public expressed a similar interest. Starting in April 2014, EPA began meeting with the City with the goal of developing a new cleanup alternative that might address some of the concerns expressed by the City and the public. The City shared the results of the meetings via a December 2014 press release and a February 2015 public meeting. The City's message was that a consolidation and capping alternative that maximizes reusable space could be beneficial to the City and the surrounding community, that total removal of the waste may not be viable, and that it could support a consolidation and capping alternative that maximizes reusable space. That alternative is presented as Alternative 2D in this Proposed Plan and is EPA's Preferred Alternative. EPA shared the new alternative with the public in draft form during an April 2015 public meeting and in final form at a June 2015 public meeting. Kalamazoo Mayor Bobby Hopewell sent a letter to Region 5 Superfund Division Director Richard Karl, on August 21, 2015, stating the City's support for Alternative 2D, and that the City is committed to providing ongoing stewardship at OU1.

## SITE CHARACTERISTICS

In 2008, MDEQ completed an RI report for OU1, which EPA approved. EPA then assumed the lead agency role for the remainder of the OU1 work and completed the FS. Significant findings from the RI are discussed below.

**Geology/Hydrogeology**

OU1 is situated on the floor of a north-south trending valley drained by Portage Creek. The Creek empties into the Kalamazoo River approximately 2.25 miles to the north. As shown below, the valley is flanked by hills formed from unconsolidated material that rise about 80 feet above Creek level to the east and 100 feet above Creek level to the west. The graphic below and Figure 3 depict the general topography of OU1 and its environs. Total relief across OU1 is approximately 70 feet, with elevations ranging from 783 feet AMSL near the Alcott Street Dam to 853 feet AMSL at the highest point of the Monarch HRDL. The land surface of OU1 generally slopes toward Portage Creek.




Surface runoff at OU1 is generally directed to Portage Creek. Runoff from the area capped during the IRMs (e.g., the Bryant HRDL and FRDLs) is currently managed through a series of engineered drainage ditches and swales, routed to a settling basin, and discharged to Portage Creek through an engineered outlet.

<u>Geology</u>

The geologic layers near OU1 generally consist of bedrock overlain by overburden. The bedrock underlying the region near the OU1 consists of the Coldwater Shale formation. The surface of the formation, which is estimated at an elevation of 650 to 700 feet AMSL near OU1, slopes downward to the southwest. The formation is greater than 500 feet thick, with bedding dipping toward the northeast. Based on the elevation range provided above, the depth to bedrock beneath OU1 is estimated to be between 100 and 150 feet.

Classified overburden soils in the region fall primarily into the Oshtemo-Kalamazoo-Glendora complex. The geologic units range from nearly level areas of very poorly-drained Glendora soil along Portage Creek to rolling, well-drained areas of Kalamazoo soil and hilly, well-drained deposits of Oshtemo soil on the upland areas. The Glendora series consists of very poorly-drained soils on floodplains along perennial rivers and streams. The soils formed in sandy alluvium. Layers of this soil are highly variable in sequence and thickness within a horizontal distance of a few feet.

Seven units were identified in the upper sand and gravel aquifer at OU1 based on investigatory borings. The units include fill, residuals, peat, sand and gravel, silt, clay, and till. Fill and residuals are not native layers but are the result of OU1 activities. Based on slug test data, the hydraulic conductivity of the upper sand unit varies considerably across OU1, ranging between $1.7 \times 10^{-2}$ to $4.9 \times 10^{-5}$ centimeters per second (cm/s). As with most clays, the residuals have low permeability when compacted. Based on the results of 10 residuals samples collected from OU1, the measured hydraulic conductivity of residuals was approximately $1.3 \times 10^{-7}$ cm/s.

Figures 4 and 5 identify the locations of representative geologic cross sections of OU1. Figure 6 shows cross section B"-B-B'-B"' which runs north-south from the City well field through OU1, as shown in Figure 4. Figure 5 shows the location of two cross sections, B-B' and F-F', which run generally east-west through the landfill; these cross sections are shown in Figure 7 and Figure 8, respectively.

Hydrogeology

The hydrogeology at or near OU1 has been evaluated in the OU1 RI, a 2009 Supplemental Groundwater Investigation (2009 Study), and a 2014 groundwater investigation (2014 Investigation). The OU1 conceptual site model (CSM) showing exposure routes and transport mechanisms for contaminants of concern (COCs) in soil and water is shown on Figure 9. The results of these studies support the CSM for OU1, and, specifically, the conclusion that there is no apparent groundwater migration pathway from OU1 to the City well fields. The 2009 Study report is included as Appendix A to the FS report for OU1. The 2014 Investigation is a part of the Administrative Record for this Proposed Plan.

The unconsolidated deposits near OU1 vary from approximately 200 to 400 feet thick. Gravelly or sandy deposits with characteristics that allow subsurface water (groundwater) to move through them are typically referred to as "aquifers." Clayey or silty deposits that do not transmit water are referred to as "aquitards" (limited water flow) or "aquicludes" (no water flow). Taken as a whole, the unconsolidated glacial materials beneath OU1 consist of interbedded aquifers, aquitards, and aquicludes throughout its depth, arrayed in more or less horizontal layers. A consistent clay or silt aquitard or aquiclude beneath OU1 is not present. However, a consistent upward vertical gradient is present at OU1 inhibiting flow to the deep aquifer.

The City well fields provided geologic information for deeper elevations which is not otherwise available near OU1. The City's Millford well fields located to the south show interbedded horizontal layers similar to those at OU1 based on a limited number of data points. The geological units at the City well fields 3 and 7 to the north indicate the presence of relatively consistent materials without interbedded layers. The City well fields 3 and 7 draw from the lowest portion of the aquifer, identified as the deep aquifer at OU1.

The 2009 Study included an evaluation of existing data from OU1, the nearby Strebor property, and the City wellhead protection model. The 2009 Study also included the collection of new groundwater elevation data from OU1 and the Strebor, Panelyte, and Performance Paper properties. The 2009 Study supported the following conclusions:

- Water is not dropping down to the elevation of the City wells, as there is an upward gradient from the lower regional aquifer upward toward the surficial aquifer.

- Shallow groundwater flow in the area is generally to the east (to Portage Creek) and not northwest toward the City well fields. Shallow groundwater from adjacent properties flows to the east and west onto OU1 (Figures 3 and 5).

- Portage Creek is the point of discharge for shallow groundwater from OU1, further directing groundwater away from the City well fields.

MDEQ generally concurred with the 2009 Study conclusions in an April 16, 2010 letter to EPA, in which MDEQ stated the following:

- Portage Creek appears to be the primary influence on the configuration of the water table surface within OU1. In the main disposal area of OU1, shallow groundwater discharges radially to Portage Creek.

- Shallow groundwater is influenced, although not completely captured, by the Portage Creek.

- Due to the upward pressure exerted by the groundwater present in the regional aquifer, the downward flow of groundwater from the surficial aquifer at OU1 to the deeper regional aquifer is highly improbable.

The 2014 Investigation included the installation of monitoring wells on OU1 at depths more consistent with the City well fields. The findings of the 2014 Investigation were consistent with the CSM for OU1 and the findings of the 2009 Study. The general groundwater flow directions established for the CSM were confirmed, with water table flow towards Portage Creek, intermediate and deep zone flows toward the north-north east, and vertical hydraulic groundwater gradients predominantly upward across OU1 and the neighboring properties. The 2014 Investigation found that a consistent lateral aquitard is not present beneath OU1.

The City has raised concerns that contamination from OU1 could migrate to the City well field. As described above, all available data suggest that a flow path from OU1 toward the City well fields is unlikely. This conclusion is based on the presence of a lateral aquitard (the previously-mentioned clay layer) beneath portions of OU1 and an upward vertical hydraulic gradient between the regional aquifer (used by the City for potable purposes) and the shallow aquifer at OU1 (which is not classified as a drinking water aquifer).

Further empirical support for the above conceptual understanding was provided by the analytical results from water samples collected by the City from its own production wells. PCBs have never been detected in the City's samples, even at trace levels. Similarly, the 2014 Investigation identified only a single PCB detection in the wells monitored at and around OU1. The well with the detection, MW-8A, is screened immediately below waste material, and the detected concentration was below both the groundwater-surface water interface (GSI) and drinking water protection criteria. There were no PCB detections in perimeter samples located outside the extents of waste material at OU1. Together, the production well data and the 2014 Investigation, therefore, support the previous findings that PCBs are not migrating off-site in groundwater.

**Nature and Extent of Contamination**

PCBs are being used as the primary indicator to define the extent of contamination at OU1. PCBs are associated with the paper residuals and appear to be the most widespread contaminant at OU1. They are present in soils and sediments due to the residuals eroding and mixing into the soils and/or sediments in certain subareas. As described in the RI, other COCs (inorganics and semi-volatile organic compounds (SVOCs)) were identified at OU1, but appear to be co-located with the PCBs. Other COCs including several inorganics, volatile organic compounds (VOCs), and SVOCs were detected in soils, sediments, and groundwater at OU1 (see Table 3). The RI report concluded the following:

- Target analyte list inorganic constituents in soils and sediments that exceed criteria appear to be associated with the PCBs identified at OU1.
- Soils with inorganic constituents may be acting as a source, resulting in low-level impacts to the groundwater.
- Target compound list (TCL) VOCs in soils, sediments, and groundwater do not appear to be associated with contaminant impact identified at OU1.
- Detected TCL SVOCs in soils and sediments appear to have a similar distribution to the contaminant impact based on the data set available.
- The groundwater impact of detected SVOCs appears to be much less extensive than the SVOCs in soil at OU1. There were no SVOC exceedances of the screening criteria in the most recent groundwater sampling event.
- Concentrations of TCL pesticides did not exceed screening criteria.
- TCL pesticides were not present in the groundwater at the time of sampling, which is consistent with the soil and sediment data. One pesticide was detected in a leachate sample below screening criteria.
- Soils with visual indicators of paper residuals can be expected to have PCB concentrations.
- During the most recent sampling, PCBs were detected in several of the groundwater seep monitoring wells located along Portage Creek near the Former Operational Areas, with PCB detections above the GSI screening criteria in two locations.

Because of the co-location of COCs, addressing the PCB contamination is expected to address the other COCs found at OU1. This will be confirmed with post-excavation confirmation sampling for all OU1 COCs during remedy implementation.

The red dots on Figures 10 and 11 depict the aerial extent of PCB-containing soils and residuals at the surface and subsurface, respectively, at OU1. PCBs are present in concentrations exceeding TSCA and Michigan Part 201 risk-based screening levels in the following areas: the soils and sediments in the Former Operational Areas, the area of the Former Bryant Mill Pond impacted by ongoing seeps, certain Residential Areas east of Portage Creek and certain neighboring Commercial Areas, in groundwater in the Western Disposal Area and Bryant HRDL/FRDLs, and in seeps in the Former Type III Landfill Area adjacent to the Bryant HRDL/FRDLs. The PCB detections in groundwater (3 of 56 monitoring well locations) and seeps (2 of 20 seep locations) in the RI, were all co-located within or adjacent to borings that contained residuals (Figure 12). For these reasons, EPA does not believe there is a groundwater plume of PCBs emanating from OU1.

Soil sample results at OU1 show isolated areas of PCBs with concentrations as high as 2,500 mg/kg. However, the reasonable maximum exposure (RME) for the soils and sediments at OU1 is 60 mg/kg. This value is the highest exposure that is reasonably expected to occur at OU1 and was calculated based upon the 95 percent upper confidence limit on the mean PCB concentration in soil, sediment, and residual samples from OU1.

EPA performed a groundwater investigation in 2014 to supplement existing groundwater data from the RI and confirm the CSM in the RI. PCB results from the 2014 sampling are shown on Figure 12. Monitoring wells were completed to deeper elevations than were previously evaluated to verify the vertical extent of contamination. PCBs were detected in 1 of 32 samples and the concentration did not exceed criteria. The percentage of inorganics detected at concentrations exceeding criteria or background were comparable to the RI data. No detections of volatile organic compounds or semi-volatile organic compounds were attributed to the Site.

Because the waste materials exhibit very low mobility and can be reliably controlled in place through consolidation and capping, EPA does not consider the waste materials at OU1 to be principal threat waste. Soil and groundwater data demonstrate that the PCBs at OU1 are not mobile within the waste and do not readily leach into groundwater.

**Fate and Transport**

EPA evaluated the following PCB fate and transport mechanisms at OU1:

- PCB transport from surface water runoff and soil erosion;
- PCB transport in groundwater;
- PCB transport in Portage Creek; and
- PCB transport in air.

In general, PCBs are relatively immobile. They are chemically- and thermally-stable, fairly inert, have low solubility in water, and have a high affinity for solids. Typically, the lower the water solubility of a chemical, the more likely it is to be adsorbed onto solids. With that high adsorption tendency, PCBs have a strong affinity for soils and suspended solids, especially those high in total organic carbon such as the paper OU1 residuals, which are composed primarily of fibrous wood material and clay. The properties of PCBs as they interact with the residuals at OU1 is discussed further in the RI.

In addition to organic content, other soil or sediment characteristics such as soil density, particle size distribution, moisture content, and permeability affect the mobility of PCBs. Meteorological and physical conditions, such as precipitation and the presence of organic colloids (micron-sized particles), can also affect the mobility of PCBs. For example, PCBs that are dissolved or sorbed to mobile particulates (for example, colloids) may migrate with groundwater in sediments and soils.

When compacted, the OU1 residuals have a low hydraulic conductivity. The hydraulic conductivity of 10 residuals samples collected from OU1 was approximately $1.3 \times 10^{-7}$ cm/s. As water does not easily flow through the residuals, the opportunities for PCBs to migrate via groundwater are low.

Based on the PCBs' high affinity to adhere to the OU1 residuals and low hydraulic conductivity of those residuals, the PCBs do not migrate significantly from or through the OU1 residuals. This finding is supported by the near absence of PCB detections in groundwater samples at OU1 and by the lack of vertical and horizontal gradients in soil, sediment, and residual samples.

Surface Water Runoff and Soil Erosion

At portions of OU1 (primarily in the Former Operational Areas), PCBs and other COCs are present in surface soils and surface residuals and are, therefore, exposed to the elements. Because these materials are located at the surface, they may be transported to the floodplain or sediments in Portage Creek by erosion or surface water runoff.

Groundwater

Based upon the RI results, PCBs do not appear to be migrating in groundwater beyond the waste areas at OU1. PCBs were detected in 3 of 56 monitoring well locations and 2 of 20 seep locations at OU1. Those detections, above screening levels, occurred only in wells screened within or immediately adjacent to the OU1 residuals. This finding supports the conclusion that PCB transport in groundwater is limited within OU1. These data, together with the hydrological conditions described above and the lack of PCB detections in City production wells, demonstrate that a groundwater migration pathway to the City well field does not exist. Discharge of groundwater to the surface water of Portage Creek is seen as the most significant potential groundwater migration pathway at OU1.

Other COCs found in groundwater at OU1 are primarily inorganic compounds. As described in the Risk Assessment, these COCs have a low level impact to Portage Creek upon discharge. Exceedances of inorganic screening levels in groundwater generally occur within areas where PCBs exceed soil screening levels.

The supplemental groundwater investigation performed in 2014 confirmed that PCBs do not appear to be migrating in groundwater. This groundwater data was comparable to data from the RI in that exceedances of inorganic screening levels generally occur within areas where PCBs exceed soil screening levels.

Direct Discharge to Portage Creek

The most significant historical source of PCBs from OU1 was the direct or indirect discharge of PCB-containing residuals to Portage Creek and the Bryant Mill Pond. The excavation of PCB-containing sediments, residuals, and soils from the Former Bryant Mill Pond Area, subsequent replacement with clean fill, and the consolidation and capping of those materials in the main body of the landfill area has isolated most of those source materials from direct contact with surface water and removed the largest source of PCBs to Portage Creek. Under current conditions, the remaining potential sources of PCBs to Portage Creek from OU1 are primarily associated with the erosion of contaminated soils and sediments.

Air

Transport of PCBs by air can occur through wind-blown dispersion or volatilization from exposed residuals. An investigation for vapor-phase and particulate-phase PCBs was performed in 1993, when the waste materials in the HRDL and FRDLs were not covered by a cap. PCBs were not detected in any of the airborne particulate-phase samples collected at OU1. Vapor phase PCB concentrations were detected within OU1 above background concentrations, but did not exceed the secondary risk screening levels under Michigan Air Toxic regulations. The subsequent completion of the TCRA and IRMs significantly reduced the area where residuals were exposed at the ground surface. Additionally, as PCBs strongly adhere to organic materials, air transport is not anticipated to be a significant transport mechanism at OU1.

## SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As noted earlier, a TCRA was conducted at OU1 in 1998-1999 to address the Former Bryant Mill Pond Area of OU1, and a series of IRM activities was conducted in the early 2000s to restrict site access and stabilize portions of OU1. The proposed response action in this Proposed Plan is intended to be the final response action for OU1. The other parts of the Site have been or will be addressed by separate response actions.

## SUMMARY OF SITE RISKS

Exposure to PCBs is the primary risk driver at OU1. MDEQ, as part of its RI activities, completed a *Site-wide Final (Revised) Human Health Risk Assessment* (HHRA) and *Final (Revised) Baseline Ecological Risk Assessment* (BERA) for the Site in 2003.

The HHRA quantitatively identified potential carcinogenic and non-carcinogenic risks to human health through exposure to media impacted with PCBs, including:

- consumption of fish by recreational and subsistence anglers;
- direct contact with PCB-contaminated materials by residents, recreational users, and construction/utility workers; and
- inhalation of dust and volatile emissions from PCB-contaminated materials.

Although MDEQ completed the HHRA for the entire Site, the assumptions made and the scenarios evaluated in the HHRA apply to OU1 as well as the other OUs.

The BERA quantitatively identified potential risks to various ecological receptors for different exposure pathways:

- direct contact with and ingestion of PCB-contaminated soils, sediments, or paper residuals by animals at OU1, and
- ingestion of PCB-contaminated animals by other animals.

In the BERA, the mink (aquatic) and robin (terrestrial) were used to represent ecological receptors.

The exposed PCB-contaminated soils, sediments, and paper residuals at OU1 present a human health risk via the direct contact exposure pathway and an ecological risk via direct contact and ingestion pathways. Exposed soils, sediments, and paper residuals currently act as a source to Portage Creek via erosion and may result in increased aquatic risk. Additionally, active groundwater seeps at OU1 discharge low levels of PCBs to Portage Creek, likely through the transport of contaminated solids that the seeping liquids encounter as they express. The greatest aquatic risk is to fish, which may consume contaminated sediments, and subsistence anglers that consume these fish.

As described above, EPA does not believe that PCBs at OU1 are migrating in groundwater. In addition, the shallow aquifer is not utilized for drinking water purposes, and zoning requires all new facilities to receive drinking water from the City's water supply. Other COCs, primarily inorganic compounds, have been identified in groundwater at OU1 and are discharging to Portage Creek. As the inorganics are at low levels and appear to be co-located with the PCBs in groundwater, EPA expects that remediation to address PCB contamination will also address these other COCs.

More details about the risks to human and ecological receptors at OU1 are provided in the OU1 FS Report and the HHRA and BERA. Preliminary Remediation Goals (PRGs) based upon those exposure scenarios are listed in Table 1 of this document.

The key risk management goals established for OU1 are associated with exposure to PCBs in soils and sediments. During the FS, EPA developed and evaluated alternatives to mitigate the risks posed by this contamination. Those alternatives are described in later sections of this Proposed Plan. As noted earlier, other COCs have been identified at OU1 and will be addressed with PCBs during the remedial action.

EPA developed PRGs for OU1 based on potential exposure pathways, risk assessments, and federal and state applicable or relevant and appropriate requirements (ARARs). The PRGs for the PCBs at OU1 are summarized in Table 1. For contaminants other than PCBs, EPA is using updated Michigan Act 451, Part 201, screening criteria and federal drinking water maximum contaminant levels as the PRGs. The PRGs and exposure routes for COCs other than PCBs are shown in Table 2. A summary of the frequency of PRG exceedances for COCs other than PCBs is provided in Table 3.

**Basis for Taking Action**

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

## REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are general descriptions of the goals to be accomplished through cleanup activities. RAOs are established by considering the medium of concern, COCs, the allowable risk range, potential exposure routes, and potential receptors. EPA has identified the following RAOs to address the risks posed by OU1:

- RAO1: Mitigate the potential for human and ecological exposure to materials at OU1 containing COC concentrations that exceed applicable risk-based cleanup criteria.
- RAO2: Mitigate the potential for COC-containing materials to migrate, by erosion or surface water runoff, into Portage Creek or onto adjacent properties.
- RAO3: Prevent contaminated waste material at OU1 from impacting groundwater and surface water.

In addition to the quantitative PRGs identified in Tables 1 and 2, EPA will require that either all residuals that are visually observed will be removed or that sufficient sampling will occur to verify that the residuals do not contain PCB or other COC concentrations above the applicable PRGs.

## SUMMARY OF REMEDIAL ALTERNATIVES

EPA developed different remedial alternatives to address the potential risks at OU1. EPA is required to evaluate a "No Action" alternative as a basis of comparison for the other alternatives. In EPA's judgment, the Preferred Alternative (Alternative 2D) identified in this Proposed Plan, or one of the other active remedial alternatives considered in this Proposed Plan, is necessary to protect human health, welfare, and/or the environment from actual or threatened releases of hazardous substances into the environment from OU1. The remedial alternatives that were evaluated in the FS as amended by the recent technical addendum that details Alternative 2D, along with their major components, are listed below. A more detailed description of each alternative is provided later in this section of the Proposed Plan.

**Alternative 1—No Further Action**

- No implementation time required; and
- Net present value cost of $110,000.

**Alternative 2A—Consolidation of Outlying Areas on the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and consolidation at Monarch HRDL.** This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (see *Common Elements* discussion below for more details);
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Excavate and pull back the creek-side edge of Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; where hydraulically connected to Portage Creek, set-back areas would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish;
- Consolidate excavated material on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Backfill Outlying Areas to original grade after excavation with the restoration of paved areas that require removal during the remedial action;
- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL;
- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Monitor groundwater to verify effectiveness of remedy;
- Implementation time: 2 years; and
- Net present value cost of $44,000,000.

**Alternative 2B—Consolidation of Outlying Areas and Monarch HRDL on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area.** This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (See *Common Elements* discussion below for more details);
- Excavate Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; areas hydraulically connected to Portage Creek would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish;
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Consolidate excavated material on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Backfill Outlying Areas to original grade after excavation with the restoration of paved areas that require removal during the remedial action;
- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;

- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Monitor groundwater to verify effectiveness of remedy;
- Implementation time: 2 years; and
- Net present value cost of $43,000,000.

**Alternative 2C—Consolidation of materials from Outlying Areas and Monarch HRDL with PCB concentrations of 500 mg/kg or less on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area, and off-site incineration of excavated soils/sediments with PCB concentrations greater than 500 mg/kg.** This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (See *Common Elements* discussion below for more details);
- Excavate Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; areas hydraulically connected to Portage Creek would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish;
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Transport all excavated materials with PCB concentrations greater than 500 mg/kg off site for incineration;
- Consolidate excavated materials with PCB concentrations of 500 mg/kg or less on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Backfill Outlying Areas to original grade after excavation with the restoration of paved areas that require removal during the remedial action;
- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area;
- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Monitor groundwater to verify effectiveness of remedy;
- Implementation time: 2 years; and
- Net present value cost of $70,000,000.

**Alternative 2D—Consolidation of Outlying Areas, Monarch HRDL and Portions of the Operations Areas into a Reduced Footprint on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area.** This alternative includes the following major components:

- Excavate the Outlying Areas, the Monarch HRDL, and portions of the Bryant HRDL/ FRDLs, Former Type III Landfill, and Western Disposal Area to achieve non-residential soil PRG of 10 mg/kg PCBs; areas hydraulically connected to Portage Creek would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish. (See *Common Elements* discussion below for more details);
- Consolidate excavated material into a reduced footprint within the onsite disposal areas to create a protective setback and developable area along the creek;
- Backfill Outlying Areas to original grade after excavation with the restoration of paved areas that require removal during the remedial action. Backfill excavated areas in the Operations Area to 1 foot above the water table and revegetate to prevent erosion of these areas;
- Install cap over the consolidated materials;
- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Monitor groundwater to verify effectiveness of remedy;
- Implementation time: 3 years; and
- Net present value cost of $63,000,000.

***Note regarding Alternatives 2A, 2B, 2C, and 2D:*** Groundwater monitoring is included in all of the alternatives that leave waste in place and/or consolidated onsite. Monitoring would include upgradient and downgradient wells to determine if COCs are migrating off-site. Additionally, for each of the Alternative 2 options, the following two sub-alternatives were considered:

- Sub-alternative (i)—Groundwater collection and treatment, which includes a system of extraction wells or trenches installed downgradient to capture groundwater before discharge to Portage Creek; and
- Sub-alternative (ii)—Slurry wall installed downgradient of groundwater flow along with extraction wells or trenches to prevent groundwater mounding behind the slurry wall.

**Alternative 3—Total Removal and Off-site Disposal.** This alternative includes the following major components:

- Excavate Outlying Areas and All Operational Areas to achieve appropriate PRGs;
- Transport all materials above PRGs off site for disposal;
- Backfill excavation to above water table elevations in Operational Areas and to original grade in the Outlying Areas;

- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Implementation time: 5 years; and
- Net present value cost of $238,000,000.

**Alternative 4—Encapsulation Containment System.** This alternative includes the following major components:

- Excavate Outlying and all Operational Areas and stockpile the excavated materials;
- Line bottom of OU1 with a 3-foot compacted clay liner (or geosynthetic equivalent) beneath two 40-mil FMLs. A leachate collection and monitoring system would be constructed between the FML layers;
- Consolidate excavated materials within the lined OU1 area;
- Install cap on consolidated materials within the lined OU1 area;
- Implement restrictive covenant to limit residential use in areas at which PCBs remain above 1 ppm;
- Implement a restrictive covenant to prevent disturbance of contaminated material under building foundations without EPA approval;
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use;
- Mitigate any filled wetlands and implement restrictive covenants to ensure that wetland areas are not disturbed in the future;
- Monitor groundwater to verify effectiveness of remedy;
- Implementation time: 10 years; and
- Net present value cost of $159,000,000.

**Common Elements of Alternatives**

All alternatives except Alternative 1 (No Further Action) include pre-design investigations with sampling of soil, sediments, and residuals to further delineate the nature and extent of PCBs exceeding the relevant PRGs in certain subareas of OU1. Each alternative includes excavation of soil and sediment above respective PRGs in Outlying Areas and in certain subareas of the Operational Area. Based on the RI, it is assumed that by addressing PCBs, other COCs would also be addressed. Confirmation sampling for PCBs and other COCs would be performed during the implementation of the remedial action to verify that respective PRGs have been achieved.

<u>Certain Operational Subareas</u>

Portions of the following subareas are contiguous and listed with the Operational Areas due to encroachment of waste material from the various disposal areas. However, the following subareas are discussed separately from the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area, due to the PRGs and proposed approach envisioned for Alternatives 2 through 4:

- **Former Raceway Channel**—Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the wetlands would be restored and an environmental covenant would be implemented to maintain the wetlands.
- **Panelyte Property**—Waste materials are believed to have encroached onto the southern portion of the Panelyte Property, including Panelyte Marsh, from the Western Disposal Area. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit residential use of this area.
- **Panelyte Marsh**—Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the wetlands would be restored and an environmental covenant would be implemented to maintain the wetlands.
- **Conrail Property**—Waste materials are believed to have encroached onto the eastern portion of the Conrail Property from the Western Disposal Area. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit residential use of this area.
- **State of Michigan Cork Street Property**—Waste materials are believed to have encroached onto the Cork Street Property from the Monarch HRDL. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit residential use of this area.
- **Residential Properties (Outlying)**—Soils exceeding the PRG of 1 mg/kg PCBs would be excavated. After confirmation samples indicate the 1 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material.
- **Commercial Properties (Outlying)**—This area includes the Alcott Street Parking Lot, Former Filter Plant, Goodwill property, former Bryant Mill property, and Consumers Power property. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. Subareas achieving PCB concentrations between 1 mg/kg and 10 mg/kg would require restrictive covenants preventing residential use. Where there are buildings that serve to mitigate direct contact but hinder the ability to remove impacted materials, restrictive covenants would be employed that would prevent disturbance of contaminated material under building foundations without EPA approval. Parking lots would be investigated and excavated to meet PRGs, as necessary.
- **Former Bryant Mill Pond Area (Outlying)** — Soils in the Former Bryant Mill Pond and sediment in the associated wetland area may have been impacted by the PCB-contaminated seeps. Soils exceeding the PRG of 10 mg/kg PCBs, floodplain soils exceeding the PRG of 6.5 to 8.1 mg/kg PCBs, and sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the respective PRGs for PCBs and the PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. Wetlands were previously

delineated in the Former Bryant Mill Pond Area, and at least 1 acre of wetland would be mitigated for each acre filled. An environmental covenant would be implemented to ensure that wetland areas are not disturbed in the future.

- **Wetland Areas**—Known wetland areas were discussed above with the associated subareas. However, if additional wetland areas with suspected PCB impacts are identified within the Outlying Areas discussed above or Operational Areas during the pre-design investigation, the wetlands would be investigated for PCBs. Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the PRGs for other COCs have been achieved, any filled wetlands would be mitigated as appropriate and an environmental covenant would be implemented to maintain the wetlands.
- **Floodplain Soils**—Known floodplain soils within the Outlying or Operational Areas were discussed with the associated subareas. However, if additional floodplain soils with suspected PCB impacts are identified within the Outlying or Operational Areas during the pre-design investigation, the area would be remediated for PCBs. Floodplain soils exceeding the PRG of 6.5 to 8.1 mg/kg PCBs would be excavated and then backfilled.
- **Sheet Pile Wall**—Except for Alternative 1, the partial or complete removal of the existing sheet pile wall along the western bank of Portage Creek would be evaluated as a component of each alternative.
- **Groundwater Monitoring**—Alternatives 2A, 2B, 2C, 2D, and 4 include a robust groundwater monitoring program to measure remedy performance, including monitoring wells located between the border of OU1 and the City's drinking well field. EPA would use this groundwater monitoring to determine whether the remedy effectively prevents the contaminated waste materials from impacting any groundwater leaving OU1. If the groundwater monitoring data indicates that the remedy is not effective and a groundwater plume has developed, EPA would develop and implement a separate groundwater remedy for OU1 if appropriate. However, at this time, there is no reason to believe that a future groundwater remedy will be needed.

- Post-removal confirmatory sampling and analysis would be performed at the excavation areas.

**Description of Alternatives**

<u>Alternative 1—No Further Action</u>

The NCP requires EPA to evaluate a No Further Action alternative when evaluating remedial options. The No Further Action alternative serves as a baseline against which the other potential remedial alternatives are compared. Under this alternative, no further active remediation would be performed in any portion of OU1. The potential for human and ecological receptors to be exposed to COCs would not be addressed, and a potential would remain for COCs to erode into Portage Creek over time because there would be no maintenance of the existing fence, cap, soil cover, or other engineered control systems put in place as part of the interim remedial measures. Operation of the groundwater collection/treatment system would also be discontinued.

Alternative 2—Consolidation and Capping

The primary element of Alternative 2 is the excavation of contamination above PRGs from certain areas of OU1 and in-place containment of the excavated materials on other portions of OU1. The Residential Properties (Outlying), the impacted portion of the Former Bryant Mill Pond Area, the Commercial Properties (Outlying), and portions of the Former Operational Areas would be excavated. The excavated materials would be consolidated on the Bryant HRDL/FRDLs area, the Former Type III Landfill area, and Western Disposal Areas, and if Alternative 2A were selected, the Monarch HRDL area. The areas used for consolidation would be covered with an engineered composite cap. The landfill would be constructed with appropriate erosion controls and other measures to protect against floods and other natural or human-induced incidents that might otherwise threaten the integrity of the disposal areas. As discussed below, four variations of Alternative 2 were developed to allow for variations in the material excavated and consolidation locations and methods.

Excavation along the perimeter of the Former Operations Areas would create a setback that would act as a protective buffer along Portage Creek and enhance long-term slope stability. All of the Alternative 2 options include long-term inspections and maintenance of the existing and newly-installed, engineered landfill caps and any remaining sheet pile. A long-term monitoring program would be implemented to verify the performance of the remedy, demonstrate that groundwater quality conforms to PRGs (Tables 1 and 2), and provide the appropriate management of landfill gas.

For the purpose of cost estimating, EPA assumed the cap would consist of six layers as shown in Figure 13. The layers are (from bottom to top): a non-woven geotextile, a 12-inch-thick (minimum) sand gas venting layer, a 30-millimeter polyvinyl chloride FML or equivalent (permeability less than $1 \times 10^{-10}$ centimeters per second), a geosynthetic drainage composite layer, a 24-inch-thick (minimum) drainage and soil protection layer, and a 6-inch-thick (minimum) vegetated, topsoil layer. The proposed cap design contains the landfill cap components required under Michigan's Natural Resources and Environmental Protection Act (NREPA), as amended, Part 115.

The existing sheet pile wall would be evaluated during design to determine whether it can be removed completely or is required to stabilize the base of the consolidation area on the side closest to Portage Creek. If the wall is required for stabilization, the wall would be cut off at ground surface and, if necessary, individual panels would be removed to allow groundwater flow to the creek, eliminating the need for the existing groundwater collection and treatment system, which will then be removed.

A groundwater monitoring network consisting of existing and new monitoring wells would be located outside the consolidation areas, included in the setback between Portage Creek and the consolidation area(s). The groundwater monitoring plan would also evaluate upgradient groundwater concentrations to determine local background conditions. For the purposes of cost estimating, EPA assumed that 24 monitoring wells would be installed under Alternative 2A, and 20 monitoring wells would be installed under Alternatives 2B, 2C, and 2D. The setback would also allow for installation of a groundwater collection and treatment system, if necessary, based on future groundwater sampling.

All of the Alternative 2 options include sub-alternatives for hydraulic control of groundwater. For sub-alternative (i), a groundwater collection and treatment system would be installed. This system would consist of groundwater extraction wells and a series of sumps and lateral drain lines. Sub-alternative (ii) would include the same groundwater collection and treatment system as sub-alternative (i), but would also include a grout slurry wall. The grout slurry wall would be installed downgradient of the Bryant HRDL/FRDLs and Monarch HRDL (if left in place) to contain impacted groundwater located within OU1. The slurry wall would extend approximately 40 feet below ground surface based on current sheet pile wall location. The slurry wall would not necessarily key into clay or bedrock; portions of the slurry wall at this depth would terminate in the upper sand zones.

Alternative 2 includes restrictive covenants to prevent exposure to PCBs after consolidation and to prohibit interference with remedy. Alternative 2 also includes informational devices; access restrictions consisting of a perimeter fence for Alternatives 2A, 2B, and 2C; and warning signs to deter access to the property. More limited fencing would be present under Alternative 2D, primarily around mechanical components of the remedy such as the gas collection system.

Any areas subject to excavation would potentially be available for redevelopment after implementation of the remedy. Placement of additional fill to reach desired grade for redevelopment, or other enhancements to promote redevelopment, are not included within this remedy. Provided that additional material is placed upon the required soil protection layer, the landfill may be available for some types of recreational reuse.

Alternative 2A—Consolidation of Outlying Areas on Former Operational Areas, including the Monarch HRDL

Under Alternative 2A, the excavated material from the Outlying Areas and perimeter areas of the Operational Areas would be consolidated on the Former Operational Areas, and materials at Monarch will be consolidated at Monarch. These areas targeted for excavation and consolidation are shown in Figure 14. After consolidation, each consolidation area would be covered with an engineered composite cap described above.

Alternative 2B—Consolidation of Outlying Areas and the Monarch HRDL on Former Operational Areas

Under Alternative 2B, the excavated material from the Outlying Areas and certain perimeter areas of the Former Operational areas would be consolidated on the Former Operational Areas. The Monarch HRDL would also be excavated and consolidated on the Bryant HRDL/FRDLs landfill. The areas targeted for excavation and consolidation are shown in Figure 15. After consolidation, the areas used for consolidation would be covered with an engineered composite cap as described above.

Alternative 2C—Consolidation of Outlying Areas and the Monarch HRDL on Former Operational Areas, with Off-site Incineration of Excavated Materials with PCB Concentrations Greater than 500 mg/kg

The extent of excavation and the consolidation areas are the same for Alternative 2C as under Alternative 2B and are shown in Figure 15. Excavated materials with PCB concentrations greater than 500 mg/kg would be transported off site for incineration. Remaining materials with PCB concentrations of 500 mg/kg or less would be consolidated on the Former Operational Areas and covered with an engineered composite cap as described above.

A pre-design investigation would be used to identify materials exceeding 500 mg/kg PCBs within the areas to be excavated. For cost-estimating purposes, EPA assumed that approximately five percent of the soils excavated from the pullback area near the Western Disposal Area and Former Type III Landfill would require off-site incineration, and that approximately two percent of soils excavated from the Outlying Areas, Monarch HRDL, and the setback between Portage Creek and Former Operational Areas would require off-site incineration. These assumptions were based on a statistical evaluation of the existing sampling data.

Alternative 2D—Consolidation of Outlying Areas, Monarch HRDL, and Portions of the Operations Areas into a Reduced Footprint on the Former Operational Areas

Alternative 2D includes the excavation of material above PRGs from the Outlying Areas, the Monarch HRDL, portions of the Bryant HRDL/ FRDLs, Former Type III Landfill, and Western Disposal Area, and consolidation into an onsite landfill encompassing 27 acres as shown in Figure 16. The resulting height of the landfill is estimated at an additional 41 feet above existing grade. The landfill will have side slopes of 4:1 with slopes at the top ranging from 6:1 to 10:1. After consolidation, the landfill would be covered with an engineered composite landfill cap as described above.

A pre-design investigation would be performed and would include a geotechnical investigation to evaluate the COC-containing materials that are currently in place or will be consolidated. Features for stabilization of the landfill materials and slopes would be included in the design, as necessary, based on the investigation results. For cost estimating purposes, stormwater management and erosion control measures are assumed to consist of two bench drains, riprap, culverts, and piping before discharging to two 1-acre stormwater detention ponds. As Alternative 2D contemplates possible reuse of OU1 with resulting potential receptors nearby, an active landfill gas collection system would be included to collect landfill gasses to prevent migration or accumulation of landfill gases that could compromise the cap.

Alternative 3—Total Removal and Off-site Disposal

The primary element of Alternative 3 is the excavation and off-site disposal of all contaminated areas of OU1 as shown in Figure 17. The excavation areas would include the following:

- All Outlying Areas other than that portion of any property that may be covered by buildings; and

- Former Operational Areas, along with portions of contiguous properties to which waste materials may have encroached from the Former Operations Areas, including portions of the Panelyte Property, the Conrail Railroad Property, and the State of Michigan's Cork Street Property.

Materials would be excavated and transported directly to off-site commercial landfills. Materials with PCB concentrations of 50 mg/kg or greater would be transported to and disposed of in approved off-site landfills permitted to receive TSCA-regulated wastes. Materials with PCB concentrations less than 50 mg/kg would be transported to and disposed of at other permitted and approved landfills. Excluded from removal at this time are any PCB-containing materials that may be located under existing buildings. EPA will seek to have environmental covenants placed on such properties which will prohibit disturbance of those materials without the consent of EPA. Therefore, such materials will be addressed if and when construction occurs at those locations.

Once cleanup goals have been achieved, the excavated areas would be backfilled with clean material, graded to mitigate ponding, and revegetated or otherwise restored to match the surrounding areas. The excavated and backfilled area would extend across approximately 65 acres.

Appropriate mitigation would be applied to any wetlands filled during the remedy, including, as appropriate, the Panelyte Marsh and the Former Monarch Raceway Channel. EPA would seek restrictive covenants to ensure that wetlands are not disturbed in the future.

Alternative 3 would include the removal of the sheet pile along the western bank of Portage Creek to the extent feasible. The existing groundwater treatment system would be decommissioned and removed, and the network of groundwater extraction trenches, sumps, and wells currently in place behind the sheet pile wall would be removed and disposed.

This alternative includes the removal of all material containing COCs above OU1 PRGs. However, if it is not feasible to remove some of the material, groundwater monitoring would be performed in areas where materials remain above cleanup levels to ensure that any remaining contamination does not contribute to groundwater contamination. Monitoring would be performed as described in Alternatives 2 and 4. EPA would seek restrictive covenants which would prohibit disturbance of those materials without the consent of EPA for any areas where COCs are left in place above PRGs.

<u>Alternative 4—Encapsulation Containment System</u>

The primary element of Alternative 4 is the full encapsulation of impacted materials onsite as shown in Figure 18. This remedy would include the following activities:

- Excavation of approximately 1,600,000 $yd^3$ of soil and/or sediment containing PCBs above the relevant PRGs;
- Sequential stockpiling of excavated materials onsite during construction of a series of landfill containment cells in the locations of the current Former Operational Areas;

- Construction of a landfill bottom liner in the excavated Former Operational Areas. For cost estimating purposes, the base of the liner would consist of a 3-foot compacted clay liner (or geosynthetic equivalent) beneath two 40-mil FMLs. A leachate collection and monitoring system would be constructed between the FML layers;
- Consolidation of the excavated materials on the newly-constructed landfill liner;
- Construction of an engineered composite landfill cap over the new landfill areas (as described in Alternative 2, except for having a 40 millimeter FML); and
- Depending on the capacity of the new landfill areas, some materials may need to be disposed of at off-site commercial landfills.

In the Outlying Areas, once excavation has been completed, the excavated areas would be backfilled with clean material, graded to mitigate ponding, and revegetated or otherwise restored to match the surrounding area. Appropriate mitigation would be applied to any wetlands filled during the remedy, including, as appropriate, the Panelyte Marsh and the Former Monarch Raceway Channel.

For purposes of illustration, this work in the Former Operational Areas could potentially be carried out in the following manner:

- Excavate soils from the Monarch HRDL and temporarily stage the soils in the Western Disposal Area. Backfill the Monarch HRDL with approximately 10 feet of clean fill to establish the base liner four feet above the water table for the disposal cell. Construct the base liner, transport approximately 75 percent of the excavated Monarch HRDL soils back to the Monarch cell; place, grade, and compact the soils; and construct the final cap. The remaining 25 percent of soils volumetrically displaced would be transported off-site for disposal;
- Repeat the above process for the Bryant HRDL/FRDLs and the Former Type III Landfill;
- Repeat the above process for the western half of the Western Disposal Area, but without constructing the final cover system; and
- Complete the process for the eastern half of the Western Disposal Area, followed by construction of the final cover system over the entire Western Disposal Area.

The containment system disposal cells would be designed and built to include a double composite base liner system constructed a minimum distance of 10 feet above the groundwater table and graded to a minimum slope of 2 percent to promote drainage. For the purposes of cost estimating, it was assumed the base liner system would consist of the following components, from top down: a 40-mil primary FML, underlain by a geosynthetic clay liner (GCL), a leachate collection system consisting of a geosynthetic drainage composite (GDC) layer draining to a pumpable sump system, a leak detection system, a secondary 40-mil FML, and a secondary 3-foot compacted clay liner (or geosynthetic equivalent). The GCL would have a maximum hydraulic conductivity of $1 \times 10^{-7}$ cm/s, and the GDC would have a minimum transmissivity of $3 \times 10^{-4}$ square meters per second.

The disposal cells would have a cap sloped to grades of no less than four percent and consisting of the following components, from top down: a 6-inch vegetative soil layer, a 24-inch-thick (minimum) drainage and soil protection layer, a GDC, a 40-mil FML, a GCL, a non-woven needle-punched geotextile, a minimum 12-inch gas-venting layer with gas vents at appropriately spaced intervals, a basal non-woven needle-punched geotextile, and a soil grading layer. The disposal cells would be constructed with appropriate erosion controls and other measures to protect against flood events and other natural or human-induced incidents that might otherwise threaten the integrity of the disposal cells. The final cover system would cover approximately 50 acres.

Approximately 500,000 $yd^3$ of materials would have to be transported off-site for disposal because the material will not fit in the containment cells (the height of the cells is limited by the desired side-slope grade). Materials with PCB concentrations of 50 mg/kg or greater would be transported to and disposed of in approved off-site landfills permitted to receive TSCA-regulated wastes. Materials with PCB concentrations less than 50 mg/kg would be transported to and disposed of at other permitted and approved landfills as appropriate. Excluded from removal are the PCB-containing materials that may be located under existing buildings. EPA will seek to have environmental covenants placed on such properties which will prohibit disturbance of those materials without the consent of EPA. Excavated areas would be backfilled with clean material, graded, and revegetated or otherwise restored to match the surrounding areas. The excavated and backfilled area would extend across approximately 65 acres.

This alternative would include evaluation of the removal of the sheet pile along the western bank of Portage Creek. The need to leave portions of the sheet pile wall in place for landfill slope and bank stability would be further evaluated in the design. The potential for groundwater mounding behind the wall would also be evaluated. The existing groundwater treatment system would be decommissioned and removed, and the network of groundwater extraction trenches, sumps, and wells currently in place behind the sheet pile wall would be removed and disposed.

Under Alternative 4, EPA would establish the same type of groundwater monitoring system as described for Alternative 2.

## EVALUATION OF ALTERNATIVES

The NCP requires EPA to use nine criteria to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan evaluates each alternative against the nine criteria and notes how each compares to the other options under consideration. More details regarding this evaluation can be found in the FS Report.

The nine criteria are divided into three groups: threshold, balancing, and modifying criteria. Alternatives that do not meet the threshold criteria are not considered further.

A summary of the comparative analysis of alternatives with respect to the threshold and balancing criteria is presented in Table 5.

## Threshold Criteria

### 1. Overall Protection of Human Health and the Environment

This criterion assesses how well the alternatives achieve and maintain protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls.

Alternative 1 would provide no improved protection over the current conditions, would provide no risk reduction, would not be protective of human health or the environment, and would not achieve RAOs.

Alternatives 2, 3, and 4 would all be protective of human health and the environment as long as all elements of the remedy, including O&M and monitoring, are properly maintained. These alternatives would achieve all three RAOs that have been established for the remedial action.

Alternatives 2, 3, and 4 each achieve protectiveness through excavation of contaminated soils with consolidation onsite beneath a landfill cap and/or off-site disposal to prevent direct contact and transportation. Of these, Alternative 2D features the largest setback from Portage Creek, and, therefore, has the lowest potential among Alternatives 2 and 4, for recontamination of Portage Creek in the event of failure of the landfill. Alternative 2C includes an off-site incineration component for the most-contaminated excavated soils. Alternative 3 includes complete removal and off-site disposal to eliminate the potential for exposure.

Under current conditions, PCBs are not migrating outside the disposal areas via groundwater. Alternatives 2 and 4 each further mitigate the potential for groundwater transport through capping, which would prevent infiltration of surface water through the consolidated soils. Alternative 4 includes the installation of a bottom liner beneath the waste materials. However, gHowiven the site conditions (impermeability of the waste and upward flow of groundwater), Alternative 4 may not be significantly more protective than Alternative 2.

The few groundwater and seep samples that had elevated PCB concentrations were generally located in areas of OU1 that were not addressed by IRMs. These areas would all be addressed by Alternatives 2, 3, and 4, which would reduce the risk posed by those pathways. Alternative 3 includes complete removal and off-site disposal to eliminate the potential for transport through seeps and groundwater.

As noted earlier, EPA analyzed groundwater data collected at and around OU1 and concluded that PCBs at concentrations that pose a risk are not migrating off-site via groundwater. For this reason, EPA believes that groundwater sub-alternatives (i) and (ii) are not necessary for the Alternative 2 options to be protective, because the addition of those systems would not significantly increase overall protectiveness.

**2. Compliance with Applicable or Relevant and Appropriate Requirements**

This criterion assesses how the alternatives comply with regulatory requirements. Federal and state regulatory requirements that are either applicable, or relevant and appropriate, are known as ARARs. Only state requirements that are more stringent than federal requirements are ARARs. ARARs for OU1 are identified in the FS and FS addendum.

Alternative 1 would not prevent stormwater or venting groundwater discharges to Portage Creek, in violation of Parts 31 and 201 of Michigan's NREPA.

Alternatives 2, 3, and 4 would all meet ARARs, as discussed below.

Alternatives 2 and 4 would rely on a risk-based method to address PCBs under TSCA and 40 C.F.R. § 761.61(c). Alternatives 2 and 4 would not pose an unreasonable risk of injury to human health or the environment pursuant to 40 C.F.R. § 761.61(c) for the following reasons: a) they would meet the PCB PRGs set forth in Table 1 for surface soils, subsurface soils, sediment, and groundwater; b) a cap would be constructed over the landfill areas to eliminate direct contact hazards and minimize infiltration[1] of precipitation through the landfill and subsequent migration of residuals or leachate from the landfill; and c) they include restrictive covenants for caps, fences, and prohibiting residential use in certain areas .

Alternative 3 would also meet TSCA and 40 C.F.R. § 761.61 through complete removal and off-site disposal of PCB contaminated materials.

Alternatives 2, 3, and 4 comply with wetlands ARARs because compensatory wetland mitigation would be provided, as necessary, in accordance with the Federal Mitigation Rule set forth at 40 C.F.R. § 230.94(c)(2-14) for any wetlands that are filled during remediation.

Under Alternatives 2 and 4 (and alternative 3 as necessary), groundwater samples would be collected and analyzed from the shallow and lower aquifers in order to monitor the effectiveness of the remedy. Groundwater monitoring would be conducted to confirm that COCs meet Michigan Part 201 GSI criteria in groundwater venting from the shallow aquifer into Portage Creek. Groundwater monitoring would occur in both the shallow and lower aquifer to confirm that COCs are not impacting the lower aquifer.,

**<u>Balancing Criteria</u>**

**3. Long-term Effectiveness and Permanence**

This criterion evaluates the effectiveness of the alternatives in protecting human health and the environment over the long term, once the cleanup is complete, including the adequacy and reliability of controls to address residual risk.

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[1] The landfill cap for Alternative 2 and Alternative 4 includes a polyvinyl chloride FML or equivalent with a permeability less than 1 x $10^{-10}$ cm/s.

With the exception of Alternative 1, each of the alternatives would be expected to meet all three RAOs and provide long-term effectiveness and permanence once the RAOs are met. The other alternatives are all combinations of proven and reliable remedial processes, and the potential for failure of those alternatives is low.

Alternatives 2 and 4, including the O&M, monitoring, and institutional controls, would achieve long-term effectiveness and permanence through onsite containment of the contaminated materials. Capping is a proven method of preventing direct contact and erosion of material containing PCBs. Alternative 2C, which includes off-site incineration of a small amount of excavated materials with PCB concentrations greater than 500 mg/kg, would not significantly increase the long-term effectiveness of the remedy because capping prevents direct contact exposure and the erosion/transport exposure route. Alternative 2D would require additional O&M for the active landfill gas collection system and for additional slope stabilization measures due to the increased height of the landfill. However, the reduced footprint of Alternative 2D decreases the area requiring O&M as a part of that alternative.

The long-term effectiveness and permanence of Alternative 2D is enhanced by the increased width of the clean set back (significantly larger than the other alternatives that leave waste in place) between the consolidation area and Portage Creek. The large set back reduces the potential for erosion of COC-containing materials into Portage Creek to help achieve RAO 2. The increased setback and stabilized stream banks will also reduce the potential for Portage Creek to undermine the base of the landfill. Moreover, the long-term effectiveness and permanence of Alternative 2D is enhanced by the anticipated long-term stewardship at OU1 due to reuse of the uncapped and capped portions of the property.

Among the capping alternatives (Alternatives 2 and 4), Alternative 2D would likely have the greatest reliability of controls, (e.g., institutional controls, access control, and maintenance of engineered barriers). Productive reuse of a site, stakeholder support of that reuse, and the resulting long-term stewardship generally increase the effectiveness of a remedy. An active presence at OU1, due to reuse, would allow for better access control, thereby minimizing trespass and associated activities that can damage the physical components of the remedy. Monitoring and maintenance activities associated with the reuse of the property will assist with the required maintenance of the remedy. In addition, more active management of the property means that problems with the remedy that do occur, such as vandalism or damage to remedy components, will likely be identified earlier than they would if active management was not performed.

Capping is an effective mechanism to prevent infiltration through materials containing PCBs. At OU1, PCBs have not been detected in groundwater outside the current disposal areas, even though some of those disposal areas are not currently capped. The installation of an engineered composite cap would further mitigate the potential for infiltration and migration of PCBs out of the waste via groundwater. Because of that cap, groundwater sub-alternatives (i) or (ii) do not significantly increase the long-term effectiveness or permanence of Alternative 2.

The Alternative 2 options include proven technologies that would provide long-term effectiveness and permanence. Alternative 4 provides an added level of protectiveness because wastes are controlled in lined, onsite containment cells.

Alternative 3 provides the greatest degree of long-term effectiveness and permanence by removing all contaminated materials with COC concentrations above PRGs from OU1 and disposing of those materials at permitted facilities.

The long-term O&M and monitoring components that would be implemented in conjunction with institutional controls under Alternative 2 and 4 options would provide the necessary mechanisms to verify the remedy is performing as anticipated over time. As a result, Alternative 4 and the Alternative 2 options are also expected to provide effective, permanent remedies. No long-term O&M or monitoring would be required under Alternative 3, with the possible exception of certain limited areas where waste may be left in place due to the close proximity to buildings.

**4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment**

This criterion evaluates the anticipated performance of the treatment technologies that may be included as part of a remedy. EPA evaluated various treatment technologies and their applicability at OU1. EPA concluded that due to the nature of the waste, practical treatment to reduce the toxicity, mobility, or volume of contamination at OU1 is not available.

Alternatives 1, 2A, 2B, 3, and 4 do not include treatment as a component of the remedy and, therefore, would not reduce the toxicity, mobility, or volume of contamination at OU1. The only remedial alternative that includes treatment as a component of the remedy is Alternative 2C. However, Alternative 2C would only treat a small percentage of the waste at OU1 through off-site incineration of excavated soils that exceed 500 mg/kg, so would not significantly reduce the toxicity, mobility, or volume of most of the contamination at OU1. Additionally, it would be difficult to identify residuals with relatively high concentrations of PCBs to target for treatment because PCB contaminated materials above 500 ppm are not clustered, but are dispersed throughout the residuals at OU1.

**5. Short-term Effectiveness**

This criterion examines the length of time needed to implement the alternatives and the effectiveness of the alternatives in protecting human health and the environment during construction of the remedy. It considers any adverse impacts that may be posed to the community, workers, and the environment during the cleanup until RAOs are achieved.

The evaluation of short-term effectiveness is primarily related to the area and volume of COC-containing materials addressed in each alternative, the time necessary to implement the remedy, potential risks to workers, and potential impacts to the community until RAOs are achieved. Short-term effectiveness is summarized in Table 4.

With the exception of Alternative 1, all of the alternatives would have some short-term impacts during construction, including increased noise from construction vehicles, the potential for airborne dust releases, increased traffic in the vicinity of OU1, increased wear on local roads, increased potential for workers to come in contact with PCB-containing materials, and other risks associated with construction work. Potential adverse impacts can be minimized through implementing a project-specific health and safety plan, keeping excavation areas properly wetted, planning truck routes to minimize disturbances to the surrounding community, and other standard best management practices, but the impacts cannot be eliminated.

For the alternatives with active remediation, the Alternative 2 options disturb the least amount of material and require the shortest construction time. Alternatives 2A, 2B, and 2C would likely take 2 years to implement, while Alternative 2D would likely take 3 years to implement and have other short-term impacts due to the additional excavation and consolidation volume. An estimated 39,000 truck trips would be required to implement Alternative 2A, and more than 49,000 truck trips would be required to implement Alternative 2B. Alternative 2C incurs additional short-term impacts associated with off-site transport. EPA estimates that an additional 1,000 truck trips (to what is required by 2B) would be required for Alternative 2C to haul materials approximately 40 miles to an intermodal facility where they would be loaded onto railcars for transport to an incineration facility. Due to the limited number and location of TSCA-permitted incineration facilities, the rail transport distance for the contaminated materials could be 1,200 miles or more. Alternative 2D would require 70,000 truck trips to implement due to the amount of soil needed to backfill excavated areas.

Alternative 2C also has greater short-term impacts than Alternatives 2A and 2B due to the potential for dispersion or erosion of excavated materials during characterization and segregation for incineration. The addition of sub-alternatives (i) or (ii) increase the short-term impacts of the Alternative 2 options, with sub-alternative (ii) having greater short-term impacts than sub-alternative (i).

Alternatives 3 and 4 present greater short-term impacts than the Alternative 2 options due to the increased volume of materials that would be disturbed and moved as well as the increased construction duration (5 years and 10 years, respectively). Because the project duration for Alternatives 3 and 4 is longer than the Alternative 2 options, they pose greater construction-related and exposure risks to workers. The additional volume of materials to be handled in Alternatives 3 and 4 would increase truck traffic near OU1 during the project. An estimated 150,000 truck trips to and from OU1 would be necessary to implement Alternative 3. During the excavation and backfilling work under Alternative 4, more than 116,000 truck trips would be necessary to transport excavated material from the Outlying Areas to the onsite disposal cells, to bring in clean fill, and to haul displaced materials to off-site disposal locations. Any increase in truck traffic carries with it an increased risk of vehicular accidents.

In addition to the impacts discussed above, there are additional adverse impacts to the local community during construction (e.g., potential for noise and dust). Such impacts could occur over a period of 2 years (Alternatives 2A, 2B, or 2C), 5 years (Alternative 3), or 10 years (Alternative 4), with corresponding burdens on the local community. Although traffic impacts associated with Alternative 4 are primarily limited to 5 years, the overall construction duration (with the potential for noise and dust) is estimated at 10 years due to onsite management and emplacement of excavated materials.

There are no short-term impacts associated with Alternative 1; however, since existing measures to control access to OU1would not be maintained, there could be an increased risk of direct exposure over the short term to individuals who trespass and come into contact with surficial contaminated materials.

**6. Implementability**

This criterion assesses the technical and administrative feasibility of an alternative and the availability of required goods and services. *Technical feasibility* considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. *Administrative feasibility* considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.

There are no technical or administrative implementability issues associated with Alternative 1 because no active remediation would take place. The primary remedial components of the Alternative 2 options, Alternative 3, and Alternative 4 are proven, readily implementable, have been used successfully as part of other environmental cleanup projects, and are expected to be reliable over the long term. All the alternatives are administratively implementable, and although no permits would be required, the substantive applicable requirements of federal and state regulations would need to be identified and would be met.

The Alternative 2 options, Alternative 3, and Alternative 4 could all be completed using readily-available conventional earth-moving equipment, and most of the necessary services and construction materials are expected to be readily available. Qualified commercial contractors with experience at other areas of the Site are available locally to perform the work.

Compared to Alternatives 2A and 2B, Alternatives 2C, 2D, 3, and 4 would be more difficult to implement due to different constraining conditions. For Alternative 2C, there is limited availability of TSCA permitted incinerators. Alternative 2D is more difficult to implement than Alternatives 2A, 2B, and 2C due to the reduced landfill footprint and increased excavation and consolidation volumes. Additional stabilization measures may be required for the underlying soils prior to consolidation and slope stabilization measures and settlement monitoring may be required due to the increased height of the landfill. For Alternative 3, the availability of solid waste and/or TSCA landfills to accept the volume of materials to be disposed of off-site could be a limiting factor in terms of construction progress and overall cost. The limited staging area available for excavated materials during construction of the containment cells would be a limiting factor for Alternative 4.

<u>Landfill Availability</u>

There are few solid waste landfills in southwest Michigan that are available to accept PCB-containing material. The facilities commonly have limits on disposal capacity and disposal rates that may affect the timely completion of Alternatives 3 and 4 in which such large volumes of PCB- and other COC-containing material would be disposed of off-site. If capacity at local solid waste facilities and TSCA landfills is exhausted, use of facilities outside of southwest Michigan could increase transport distances for off-site disposal, and consequentially increase risks and costs.

Construction of the Containment Cells

Additional implementability challenges associated with construction of the containment cells in Alternative 4 include sequencing and space constraints, developing a plan for excavating nearly 1,600,000 $yd^3$ of COC-containing materials, constructing the full-encapsulation disposal cells, and replacing the excavated materials in the cells. As each containment cell is sequentially constructed, a successively smaller area would be available onsite for staging of clean materials and temporary storage of COC-containing materials. Eventually, onsite capacity would be depleted, and a substantial volume of material would need to be disposed of off-site. Approximately 25 percent of the soils targeted for excavation and placement in the Former Operational Areas and all of the soils excavated from the Outlying Areas would be displaced, resulting in more than 500,000 $yd^3$ of materials being transported off-site for disposal. This has a significant impact on both the implementability and cost of this alternative. The control and management of surface water runoff from the temporarily-stored COC-containing materials would also become increasingly challenging as less area would be available for the operations under Alternative 4.

## 7. Cost

This criterion evaluates the capital and O&M costs of each alternative. Present-worth costs are presented to help compare costs among alternatives with different implementation times.

The costs for the range of alternatives and sub-alternatives presented in this Proposed Plan are summarized in the table below. The cost estimates are consistent with an FS-level of estimation, with an accuracy of +50 to -30 percent. While Alternative 1 has no associated capital or O&M costs since there would be no further actions taken, five-year reviews would be required and those periodic costs are reflected in the table below.

**Summary of Remedial Alternative Costs**
***Allied Landfill—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund Site***

| Alternative | Estimated Capital Cost | Estimated O&M Cost | Estimated Periodic Cost | Total Present-worth Cost |
|---|---|---|---|---|
| Alternative 1 | $0 | $0 | $110,000 | $110,0000 |
| Alternative 2A | $38 million | $6.7 million | $110,000 | $44 million |
| Subalternative (i) | $1.7 million | $2.7 million | $0 | $4.4 million |
| Subalternative (ii) | $11 million | $2.7 million | $0 | $14 million |
| Alternative 2B | $38 million | $5.0 million | $110,000 | $43 million |
| Alternative 2C | $65 million | $5.0 million | $110,000 | $70 million |
| Alternative 2D | $57 million | $5.8 million | $110,000 | $63 million |

| | | | | |
|---|---|---|---|---|
| Subalternative (i) | $1.5 million | $2.7 million | $0 | $4.3 million |
| Subalternative (ii) | $9.2 million | $2.7 million | $0 | $12 million |
| Alternative 3 | $238 million | $0 million | $110,000 | $238 million |
| Alternative 4 | $154 million | $5.0 million | $110,000 | $159 million |

Note: The costs for the sub-alternatives under the Alternative 2 options would be in addition to the cost of each respective option.

**Modifying Criteria**

### 8. State/Support Agency Acceptance

This criterion considers the state's preferences among or concerns about the alternatives, including comments on regulatory criteria or proposed use of waivers.

EPA collaborated with MDEQ and the City in developing the concepts upon which Alternative 2D are based. The State supports Alternative 2D.

### 9. Community Acceptance

This criterion considers the community's preferences or concerns about the alternatives. Community acceptance of the preferred alternative will be fully evaluated after the public comment period ends and will be described in the Record of Decision. Among the waste-in-place alternatives, Alternative 2D has the most support from the City and other stakeholders. As previously stated, Mayor Hopewell of Kalamazoo sent EPA a letter sharing his support for Alternative 2D.

## SUMMARY OF THE PREFERRED ALTERNATIVE

EPA's preferred alternative for addressing the contamination at Allied Landfill is Alternative 2D—Consolidation of Outlying Areas, Monarch HRDL, and Portions of the Operations Areas into a Reduced Footprint on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area._Alternative 2D meets the threshold criteria, offers a high degree of long-term effectiveness and permanence, and represents the best balance among the alternatives with respect to long-term and short-term effectiveness, implementability, and cost. Alternative 2D would meet the RAOs because it would:

- prevent human and ecological exposure to contaminated materials at OU1;
- prevent the most significant route of exposure - erosion and off-site migration of contaminated materials from OU1; and
- prevent contaminated material at OU1 from impacting groundwater or surface water emanating from OU1.

EPA believes that Alternative 2D is the appropriate remedy for OU1 given the immobility of PCB contamination as evidenced by both soil and groundwater data. The fact that PCB contamination is not migrating to groundwater at levels that pose a risk to human health or the environment demonstrates that the waste can be reliably contained in place. Alternative 2D would achieve the RAOs within a reasonable timeframe of three years. While Alternative 2D would pose more short-term adverse impacts than Alternatives 2A, 2B, and 2C, it would have significantly greater long-term effectiveness and permanence due to the anticipated long-term stewardship at the Site and the size of the buffer between the waste and Portage Creek. Implementation of Alternative 2D would also require a shorter timeframe than Alternatives 3 or 4. The shorter construction duration for Alternative 2D also would result in fewer short-term adverse impacts to the local community than the alternatives that would require a longer timeframe to implement, and would not incur the higher risks associated with exposing and handling all of the waste that would be associated with Alternatives 3 or 4.

While Alternative 2D is projected to cost more than Alternatives 2A and 2B, it is still cost-effective due to its higher long-term effectiveness and permanence. Alternatives 3 and 4 are not cost-effective as they cost orders of magnitude greater than Alternative 2D without a significantly greater reduction in risk. Alternatives 2C is not cost-effective as the added cost of treatment featured in the remedy does not increase protectiveness. Alternative 2C may also be more difficult to implement, because residuals with high concentrations of PCBs are not aggregated, making them difficult to locate and transport to one of the few available incinerators. Alternatives 2A, 2B, and 2C lack the features, such as the larger setback of the waste and the anticipated stewardship, that lead to the higher long-term effectiveness and permanence of Alternative 2D.

EPA also believes that among the Alternative 2 options, 2D will have the greatest amount of public support.

Based on the information available at this time, EPA believes that Alternative 2D meets the threshold criteria and provides the best balance of tradeoffs among the alternatives with respect to balancing and modifying criteria. EPA and the State believe the preferred alternative, Alternative 2D, satisfies the following statutory requirements of CERCLA § 121(b): (1) protective of human health and the environment; (2) comply with ARARs; (3) cost-effective; and (4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative does not include a treatment component, so it does not satisfy the statutory preference for treatment as a principal element. However, EPA does not consider the wastes at OU1 to be principal threat wastes because they do not appear to act as a source material and can be reliably contained in place due to their immobility. The preferred alternative may change in response to public comment or new information.

## COMMUNITY PARTICIPATION

EPA and MDEQ provide information regarding the cleanup of OU1 to the public through public meetings, the Administrative Record for the Site, the Site Information Repository at the

Kalamazoo Public Library, and announcements published in the local newspapers. EPA and MDEQ encourage the public to gain a comprehensive understanding of the Site by reviewing this Proposed Plan and the information available at the public repository.

The dates for the public comment period; the date, location, and time of the public meeting; and the locations of the Administrative Record are provided on the front page of this Proposed Plan.

**Table 1 - Summary of Preliminary Remediation Goals Established by EPA for PCBs**
*OU1 Feasibility Study Report—Allied Paper, Inc./ Portage Creek/Kalamazoo River Superfund Site*

| Medium | Pathway | Exposure Scenario | PCB PRG | Basis |
|---|---|---|---|---|
| Soils | Human Health | Residential | 1.0 mg/kg[a] | 40 CFR §761.61(a)(4) |
| | | Non-Residential | 10 mg/kg[b] | 40 CFR §761.61(a)(4) |
| | | Recreational | 23 mg/kg[c] | HHRA |
| | Ecological | Aquatic | 0.5–0.6 mg/kg | BERA |
| | | Terrestrial | 6.5–8.1 mg/kg | BERA |
| Subsurface Soils | Human Health | Residential | 1.0 mg/kg[a] | 40 CFR §761.61(a)(4) |
| | | Non-Residential | 10 mg/kg[b] | 40 CFR §761.61(a)(4) |
| Surface and Subsurface Sediments | Human Health | Recreational | 23 mg/kg[c] | HHRA |
| | | Terrestrial | 6.5–8.1 mg/kg | BERA |
| | | Fish Consumption | 0.33 mg/kg[c,d] | HHRA |
| | Ecological | Aquatic | 0.5–0.6 mg/kg | BERA |
| Groundwater (including seeps) | Human Health | Direct Contact | 3.3 µg/L[e] | MI Part 201 direct contact criteria |
| | | Groundwater-Surface Water Interface (GSI) | 0.2 µg/L[f] | MI Part 201 GSI criteria |
| Residuals | N/A | Qualitative: Where an excavation is proposed, all visible residuals are to be removed unless analytical data are available to confirm PCBs (if present) are below applicable criteria. | | |

Notes:

[a] Based on high-occupancy cleanup level (without conditions) set forth in 40 CFR § 761.61(a)(4).
[b] Based on 40 CFR §761.61(a)(4) with restrictive covenant prohibiting residential use.
[c] Based on recreational exposure as developed in HHRA.
[d] Default sediment criteria of 0.33 mg/kg will be applied to shallow soil in areas of periodic inundation due to the potential runoff of shallow soils into surface water. Evaluation of contaminated soil runoff to surface water required under R299.5728(f).
[e] Groundwater for use as drinking water is not considered a complete pathway so the Part 201 Drinking Water criteria of 0.5 microgram per liter (µg/L) was not used. The Part 201 direct contact criteria were used for protection of human health due to the presence of seeps.
[f] The groundwater criteria protective of surface water is a PRG where the GSI is present (MCL 324.20120e and Part 31).
BERA = baseline ecological risk assessment; HHRA = human health risk assessment; mg/kg = milligrams per kilogram;

N/A = not applicable

Source: CH2M HILL 2009

Table 2 - Summary of Preliminary Remediation Goals for COCs other than PCBs
Allied Landfill—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

| | Soils/Sediments (µg/kg) | | | | | Groundwater and Seeps [a] (µg/L) | |
|---|---|---|---|---|---|---|---|
| Analyte | Statewide Default Background Level | Residential Drinking Water Protection Criteria & RBSLs | Groundwater Surface Water Interface Protection Criteria and RBSLs | Residential Direct Contact Criteria & RBSLs | Non-Residential Direct Contact Criteria & RBSLs | Residential Drinking Water Criteria & RBSLs | Groundwater Surface Water Interface Criteria & RBSL |
| **SVOCs** | | | | | | | |
| 4-methylphenol | N/A | 7,400 | 1,000 | 11,000,000 | 36,000,000 | 370 | 30 |
| **PCDD/PCDF [b]** | | | | | | | |
| Total TCDD Equivalent(O) | N/A | NLL | NLL | 0.09 | 0.99 | N/A | |
| **Inorganics** | | | | | | | |
| Aluminum (B) | 6,900,000 | 1,000 | N/A | 50,000,000 | 370,000,000 | 50 | N/A |
| Antimony | N/A | 4,300 | 94,000 | 180,000 | 670,000 | 6 | 130 |
| Arsenic | 5,800 | 4,600 | 4,600 | 7,600 | 37,000 | 10 | 10 |
| Barium (B) | 75,000 [c] | 1,300,000 | 660,000 (G) | 37,000,000 | 130,000,000 | 2,000 | 1,000 (G) |
| Cadmium (B) | 1,200 [c] | 6,000 | 3,000 (G) | 550,000 | 2,100,000 | 5 | 2.5 (G) |
| Chromium | N/A | 30,000 | 3,300 | 2,500,000 | 9,200,000 | 100 | 11 |
| Cobalt | 6,800 | 800 | 2,000 | 2,600,000 | 9,000,000 | 40 | 100 |
| Copper | 32,000 [c] | 5,800,000 | 100,000 (G) | 20,000,000 | 73,000,000 | 1,000 | 18 (G) |
| Cyanide | 390 | 4,000 | 100 | 12,000 | 250,000 | 200 | 5.2 |
| Iron (B) | 12,000,000 | 6,000 | N/A | 160,000,000 | 580,000,000 | 300 (E) | N/A |
| Lead (B) | 21,000 [c] | 700,000 | 2,500,000 (G) | 400,000 | 900,000 | 4 | 14 (G) |
| Magnesium (B) | N/A | 8,000,000 | N/A | 1,000,000,000 | 1,000,000,000 | 400,000 | N/A |
| Manganese (B) | 440,000 | 1,000 | 26,000 (G) | 25,000,000 | 90,000,000 | 50 | 1,300 (G) |
| Mercury | 130 | 1,700 | 50 | 160,000 | 580,000 | 2 | 0.0013 |
| Nickel | 20,000 [c] | 100,000 | 100,000 (G) | 40,000,000 | 150,000,000 | 100 | 100 (G) |
| Selenium | 410 | 4,000 | 400 | 2,600,000 | 9,600,000 | 50 | 5 |
| Zinc | 47,000 [c] | 2,400,000 | 230,000 (G) | 170,000,000 | 630,000,000 | 2,400 | 235 (G) |

[a] Only the data from the 2002–2003 groundwater and seep samples are summarized to reflect conditions after removal.
[b] Dioxin and furans only were sampled in 1998.
[c] Background value used in RI as screening criteria; lowest risk-based level highlighted used for COC comparison.

N/A = Not Applicable, NLL= Not likely to leach, RBSL = risk-based screening level, µg/kg = micrograms per kilogram
(B) Background, as defined in R 299.5701(b), may be substituted if higher than the calculated cleanup criterion.
(E) Criterion is the aesthetic drinking water value, as required by § 20120a(5) of NREPA 1994 PA 451, as amended by NREPA of 1994.
(G) Calculated value dependent on ph, hardness.

(O) The concentration of all polychlorinated and polybrominated dibenzodioxin and dibenzofuran isomers present at a facility, expressed as an equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin based upon their relative potency, shall be added together and compared to the criteria for 2,3,7,8- tetrachlorodibenzo-p-dioxin.
Highlighted cells = lowest applicable criteria.
Source: Non-Residential Part 201 Generic Cleanup Criteria and Screening Levels; Part 213 Tier 1 Risk-Based Screening Levels, document release date March 25, 2011.

TABLE 3

**Summary of VOCs, SVOCs, Pesticides, PCDD/PCDF, and Inorganic Exceedances**

***OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site***

| Analyte | Surface Soils | Subsurface Soils | Surface Sediments | Subsurface Sediments | Groundwater[a] | Seeps[a] |
|---|---|---|---|---|---|---|
| **VOCs** | | | | | | |
| Carbon Tetrachloride | | 1/54 | | | | |
| Acetone | | | 1/2 | | | |
| **SVOCs** | | | | | | |
| Acenaphthene | | | 1/2 | | | |
| Carbazole | | | 1/2 | | | |
| Dibenzofuran | | | 1/2 | | | |
| Phenanthrene | | 1/54 | | | | |
| 4-methylphenol | | 12/54 | | | | |
| Naphthalene | | 1/54 | 1/2 | | | |
| Pentachlorophenol | | 1/54 | 1/2 | | | |
| **Pesticides** | | | | | | |
| None | | | | | | |
| **PCDD/PCDF[b]** | | | | | | |
| Total TCDD Equivalent | 1/8 | | | | | |
| **Inorganics** | | | | | | |
| Aluminum | 1/2 | 26/55 | | | 5/72 | 1/37 |
| Antimony | | 7/55 | | | | |
| Arsenic | 1/2 | 9/54 | 1/2 | | 23/72 | 10/37 |
| Barium | | 23/55 | 1/2 | 1/1 | 4/72 | 4/37 |
| Cadmium | | 5/55 | | | | |
| Chromium | 2/2 | 53/55 | 2/2 | 1/1 | 1/72 | |
| Cobalt | | 6/55 | | | | |
| Copper | | 23/55 | | 1/1 | | |
| Cyanide | | 21/54 | | | 4/72 | 3/37 |
| Iron | 1/2 | 8/55 | 1/2 | 1/1 | 64/72 | 31/37 |
| Lead | 1/2 | 20/55 | 1/2 | 1/1 | 1/72 | |
| Magnesium | | 13/55 | | | | |
| Manganese | | 4/55 | | | 66/72 | 36/37 |
| Mercury | | 20/55 | | 1/1 | | |
| Nickel | | 1/55 | | 1/1 | 4/72 | 1/37 |
| Selenium | | 10/55 | 1/2 | 1/1 | | |
| Silver | | | | 1/1 | 2/72 | |
| Sodium | | | | | 4/72 | |
| Vanadium | | | | | 1/72 | 1/37 |
| Zinc | | 28/45 | 1/2 | 1/1 | 7/72 | |

Note:
x/y = number of samples (x) exceeding screening level criteria out of number of samples (y)
[a] Only the data from the 2002/2003 groundwater and seep samples are summarized to reflect conditions after removal
[b] Dioxin and furans only sampled in surface soils in 1998
PCDD = polychlorinated dibenzodioxins; PCDF = polychlorinated dibenzofurans

TABLE 4
**Summary of Short-term Effectiveness Considerations**
*Allied Landfill—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

| Alternative | Total Area Addressed | Total Volume of COC-Containing Materials Excavated | Duration | Worker Risks | Community Impacts |
|---|---|---|---|---|---|
| Alternative 1 | No areas addressed | No volume of impacted PCB-containing materials addressed | No time period to implement | No worker risks from implementation as no action is taken. | Potential off-site migration of COC-containing materials. |
| Alternative 2A | 65 acres, 48 acre cap | 350,000 yd3 | Approximately 2 years | Least of the active alternatives; managed by health and safety plan. | Associated with dust, noise, and truck traffic. |
| Alternative 2B | 65 acres, 42 acre cap | 479,000 yd3 | Approximately 2 years | Slightly increased due to moving Monarch HRDL; managed by health and safety plan. | Slightly increased due to dust, noise, and truck traffic. |
| Alternative 2C | 65 acres, 42 acre cap | 479,000 yd3 | Approximately 2 years | Greater than 2A and 2B due to potential exposure during characterization and transportation. | Greater than 2A and 2B due to additional management for characterization and off-site transport. |
| Alternative 2D | 65 acres, 27 acre cap | 920,000 yd3 | Approximately 3 years | Greater than 2A, 2B, or 2C due to increased excavation and consolidation volume. | Greater than 2A, 2B, and 2C due to longer construction duration and transport of backfill materials. |
| Subalternative (i) | N/A | N/A | Concurrent with Alternative 2 Options, but indefinite O&M | Risks are easily managed by health and safety plan. Continued risks present with operation and maintenance of treatment system. | Slightly increased over Alternative 2 options during construction due to well installation and treatment system construction. |
| Subalternative (ii) | N/A | N/A | Concurrent with Alternative 2 Options, but indefinite O&M | Greater risks than subalternative (i) due to construction of slurry wall. Similar O&M risks. | Slightly increased over Alternative 2 options during construction due to well installation and treatment system construction. Greater than subalternative (i) due to slurry wall construction. |

TABLE 4
**Summary of Short-term Effectiveness Considerations**
*Allied Landfill—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

| **Alternative** | **Total Area Addressed** | **Total Volume of COC-Containing Materials Excavated** | **Duration** | **Worker Risks** | **Community Impacts** |
|---|---|---|---|---|---|
| Alternative 3 | 65 acres | 1,600,000 yd3 | 5 years | Greater than Alternative 2 given the area/volume of targeted material; increased travel for disposal and increased project duration. | Greater than Alternative 2 due to noise, dust, and increased truck traffic, which would average 115 trips daily in and out of OU1 for the duration of the project. Greatest number of miles driven due to volume transported to disposal facilities with limited locations. |
| Alternative 4 | 65 acres, 48 acre landfill | 1,600,000 yd3 | 10 years | Greater than Alternatives 2 and 3 given the area/volume of targeted material and significantly increased project duration. | Greater than Alternatives 2 and 3 due to noise and dust over the longest project duration. Slightly fewer truck trips than Alternative 3, but 1/3 of the miles outside OU1 due to decreased volume transported to disposal facilities. |

TABLE 5

**Comparative Analysis of Alternatives**

*Allied Landfill—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

| Alternative | Description | Overall Protection | Compliance with ARARs | Long-term Effectiveness | Reduction of Toxicity, Mobility, or Volume through Treatment | Short-term Effectiveness | Implementability | Cost |
|---|---|---|---|---|---|---|---|---|
| **Alternative 1** | **No action** | Not protective. No action would be taken. | Would not meet ARARs | Not effective. Site conditions would remain the same. | No reduction of toxicity, mobility, or volume. | No worker risks. No action to be taken. | Implementable as no action would be taken. | $110,000 |
| **Alternative 2** | **Consolidation and capping** | | | | | | | |
| 2A | Construct caps on both Monarch and Operations areas | Protective. Remaining exposed contamination would be covered and contained. Infiltration of surface water would be minimized. | Meets ARARS | Effective. Larger landfill footprint requiring O&M than Alternatives 2B, 2C, and 2D. | No reduction of toxicity, mobility, or volume would be achieved. | Implementation over 2-year period, most effective of active alternatives. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts: associated dust, noise, and traffic. | Proven technology has been implemented at similar OUs. | $44,000,000 |
| 2B | Consolidate Monarch within Operations areas | Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the operations area would reduce the amount of monitoring required. | Meets ARARS | Effective | No reduction of toxicity, mobility, or volume would be achieved. | Implementation over 2-year period, slightly longer than 2A. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts: associated dust, noise, and traffic. | Proven technology has been implemented at similar OUs. Combining Monarch on the Operations Area would reduce the footprint of contamination. | $43,000,000 |
| 2C | Consolidate Monarch within operations areas and transport excavated soils with PCBs >500 mg/kg off-site for incineration | Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the operations area would reduce the amount of monitoring required. Off-site incineration of some of the highest PCB concentrations would be slightly more protective. | Meets ARARs | Effective | Reduction of toxicity and volume would be achieved through treatment of a portion of the material. | Implementation over 2-year period, slightly longer than 2A and 2B. Worker risk associated with dermal contact, inhalation, and ingestion due to increased management with characterization and segregation. Risks are controllable. Community impacts: associated dust, noise, traffic, and off-site transportation of contaminated materials. | Proven technology has been implemented at similar OUs. Combining Monarch on the operations area would reduce the footprint of contamination. TSCA-permitted incinerators are in limited quantity. Identifying, segregating and shipping make 2C more difficult to implement. | $70,000,000 |
| 2D | Consolidate Monarch and portions of Operations Areas under an approximate 27 acre cap. | Protective. Remaining exposed contamination would be covered and contained. | Meets ARARs | Effective. Increased O&M requirements over Alternatives 2A, 2B, and 2C. Community stewardship may help facilitate the monitoring and maintenance of the cap and effectiveness of controls. Provides larger clean buffer along Portage Creek. | No reduction of toxicity, mobility, or volume would be achieved. | Implementation over 3-year period is longer than 2A, 2B, or 2C resulting in increases to worker risk associated with inhalation and ingestion. Community impacts: associated dust and noise during construction and increased traffic associated with trucking backfill materials. | Proven technology has been implemented at similar OUs. Implementability challenges are increased due to the consolidation on a smaller footprint resulting in a taller landfill. Additional stabilization measures may be required. | $63,000,000 |

TABLE 5

**Comparative Analysis of Alternatives**

*Allied Landfill—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

| Alternative | Description | Overall Protection | Compliance with ARARs | Long-term Effectiveness | Reduction of Toxicity, Mobility, or Volume through Treatment | Short-term Effectiveness | Implementability | Cost |
|---|---|---|---|---|---|---|---|---|
| Subalternative (i) | Groundwater collection and treatment system | Protective. Achieves RAO 3 with collection and treatment of potentially impacted groundwater. | Meets ARARs | Effective | Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater. | Manageable risk associated with the installation of wells and construction of treatment system. | Proven technology. | $4,400,000 for Alternative 2A<br>$4,300,000 for Alternative 2B, 2C or 2D |
| Subalternative (ii) | Groundwater collection and treatment system with slurry wall | Achieves RAO 3 with collection and treatment of potentially impacted groundwater, but may create mounding or otherwise alter groundwater flow. | Meets ARARs | Effective | Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater. | Increased short-term risks to construction worker and environment over subalternative (i) during installation of the slurry wall. Community impacts; associated dust, noise, and traffic associated with slurry wall construction. | Proven technology. Implementation may result in groundwater mounding or short-circuiting around the barrier if operation of the groundwater treatment system ceased. | $14,000,000 for Alternative 2A<br>$12,000,000 for Alternative 2B, 2C or 2D |
| **Alternative 3** | **Total Removal and Off-site Disposal** | Protective. Contamination would be disposed of at an approved landfill facility both hazardous and non-hazardous. | Meets ARARS | More effective than Alternative 2 due to removal from OU1. No cover maintenance or source for potential groundwater impacts. | No reduction of toxicity, mobility, or volume would be achieved. Volume may be increased if soils require dewatering by addition of cement. | Implementation over 5-year period. Worker risk associated with dermal contact, inhalation and ingestion would occur over a longer period of time. Risks are controllable. Community impacts: associated dust, noise, and traffic. | Proven technology, landfill space in the area could be limited requiring the hauling of waste a significant distance from OU1. | $238,000,000 |
| **Alternative 4** | **Encapsulation Containment System** | Protective. Little advantage achieved by construction of the liner. Compacted waste can already achieve $1 \times 10^{-7}$ centimeters per second hydraulic conductivity, limiting groundwater flow through the material. | Meets ARARS | More effective than Alternative 2. The source material is fully encapsulated further minimizing potential for groundwater impacts. | No reduction of toxicity, mobility, or volume would be achieved. | Implementation over 10-year period. Worker risk associated with dermal contact, inhalation, and ingestion would occur over a longer period of time. Risks are controllable. Community impacts: associated dust and noise is the least short-term effective alternative. | Proven technology. | $159,000,000 |